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PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE
in its capacity as elected Office

Date of mailing (day/month/year) 27 March 2001 (27.03.01)	
International application No. PCT/GB00/02483	Applicant's or agent's file reference SAHO1148WO
International filing date (day/month/year) 26 June 2000 (26.06.00)	Priority date (day/month/year) 15 July 1999 (15.07.99)
Applicant BLENKINSOP, Philip, Thomas	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

05 February 2001 (05.02.01)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Zakaria EL KHODARY Telephone No.: (41-22) 338.83.38
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(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
25 January 2001 (25.01.2001)

PCT

(10) International Publication Number
WO 01/05687 A1

(51) International Patent Classification⁷: B65G 1/04, 51/02

(74) Agent: GILL JENNINGS & EVERY; Broadgate House,
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(21) International Application Number: PCT/GB00/02483

(22) International Filing Date: 26 June 2000 (26.06.2000)

(25) Filing Language: English

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(30) Priority Data:
99305619.1 15 July 1999 (15.07.1999) EP

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TECHNOLOGY PARTNERSHIP PLC [GB/GB]; Mel-
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(81) Designated States (national): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ,
DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR,
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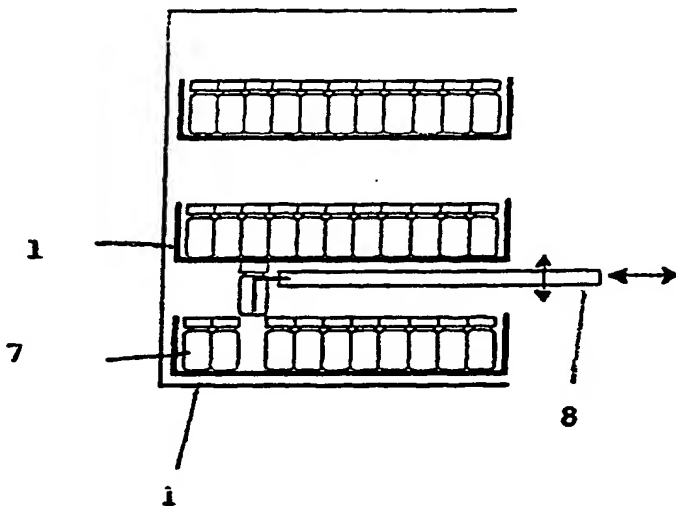
— With international search report.

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(72) Inventor; and

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(54) Title: STORAGE AND RETRIEVAL SYSTEM



(57) Abstract: A storage and retrieval system
comprises at least one storage tray comprising plural
storage holes. A gas supply manifold for supplies,
in use, pressurised gas to at least one gas supply port.
The tray can be moved with respect to the manifold
in order to align a selected storage hole in the tray
with the port such that, in use, pressurised gas can
be applied to the selected hole via the port in order to
allow controlled movement of container stored in the
selected hole to a position in which it can be retrieved
from the tray.

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STORAGE AND RETRIEVAL SYSTEM

This invention relates to a storage and retrieval
5 system.

Storage and retrieval systems have, of course, been known for many years. In recent years there have been many attempts to alternate such systems in order to improve accuracy of storage, ensure stock records are accurate, and
10 also to enable the employment of storage and retrieval systems as part of a larger automated process.

Such systems can be unwieldy, however. They tend to take up a considerable amount of space, require complex handling machinery, and can take a considerable amount of
15 time to select and retrieve the necessary item. Two specific known systems are discussed in more detail below.

The present invention seeks to overcome some of the problems associated with prior art arrangements by providing a system which is extremely simple, requires
20 minimal additional area to be provided for retrieval, and has speedy access to all of the stored items.

According to the present invention there is provided a storage and retrieval system comprising:

at least one storage tray comprising plural storage
25 holes; and

a gas supply manifold for supplying, in use, pressurised gas to at least one gas supply port; wherein
the tray can be moved with respect to the manifold in order to align a selected storage hole in the tray with the
30 port such that, in use, pressurised gas can be applied to the selected hole via the port in order to allow controlled movement of container stored in the selected hole to a position in which it can be retrieved from the tray.

The pressurised gas may raise the container.

35 Each hole may have a retaining member for retaining a container therein.

There may be provided plural trays, one arranged above another. In this case, each tray may have at least one through port therein in order to allow a container to pass through the tray when the through port is aligned with a manifold port.

The manifold may have plural ports formed therein.

The trays may be circular in shape.

The trays may be rotatable with respect to the manifold.

An example of the present invention will now be described with reference to the accompanying drawings, in which:

Figs. 1 and 2 are schematic side views of two prior art storage and retrieval arrangements;

Fig. 3 is a schematic side view of an example of the present invention;

Fig. 4 is a side perspective and plan view of the example of Fig. 3; and

Fig. 5 is a schematic side view of an example of the present invention during operation.

Figs. 1 and 2 show examples of known storage and retrieval systems. In both cases containers 7 are stored in a regular matrix on trays 1 which are arranged vertically. In the arrangement of Fig. 1 sufficient space is left between each tray 1 in order to enable the lifting and removal of a container 7 by a retrieval arm 8. Such an arrangement requires a number of drive mechanisms to ensure adequate movement of the arm 8, and has reduced storage density because of the need to provide a clearance space for access by the arm 8 to individual containers 7.

Fig. 2 shows a second example in which trays 1 are stacked without any clearance space, and in which individual trays 1 can be drawn out of alignment with the other trays and an arm 8 employed to remove a selected container 7. Whilst this prior art device improves storage density, it still requires a complex retrieval drive mechanism, with the added complexity of a mechanism for

moving individual trays 1. Because each tray 1 has a high mass, it can be extremely costly to provide a mechanism which moves the trays at high speed or, alternatively, the retrieval process can be slow. A further disadvantage is that a considerable amount of floor space is needed to accommodate the storage mechanism in view of the need to draw individual trays 1 out from the system.

Fig. 3 is a side cross-sectional view of an example of the present invention. Components corresponding to those shown in Figs. 1 and 2 are numbered identically. In this example trays 1 have a plurality of storage holes 2, each arranged to accept, in use, a container 7. Fig. 4 shows how the holes 2 are arranged circumferentially within an individual tray 1. The trays 1 are arranged so that they can rotate around a single axis 3. Each of the storage hole 2 has a container retaining member 4 associated therewith, the purpose of which will be described below. Each tray 1 also has at least one through port 5 which has a similar cross-sectional area to the holes 2, but which has no retaining member 4. The trays 1 are arranged such that the through ports 5 on each tray 1 can be aligned and also placed in alignment with a port 6 in a gas manifold positioned, in this example, below the trays 1. In use, the port 6 supplies pressurised gas, in most applications air, up through the through ports 5. In most cases there will be a plurality of ports 6, the number of which corresponds to the number of through ports 5 provided in each tray 1.

The system of the invention can be arranged either to retrieve and store single containers or, alternatively, to remove a group of containers quickly without any particular need for a fixed sequence in which they are retrieved.

Fig. 5 shows the sequence of events when retrieving a single container. In the example of Fig. 5 slidable, rather than rotatable, trays 1 are shown, although the operation of both is very similar. In order to retrieve a container 7, the tray 1 containing the appropriate

container 7 is moved to a position in which the desired container 7 is above port 6. All the other trays 1 are arranged such that their appropriate through port 5 is also in alignment with port 6. Pressurised gas is then applied through the port 6 and the container 7 is lifted from the retaining member 4 until it is proud of the top tray 1 in the system and in a position for retrieval. The tray containing the container can then be moved such that its through port 5 is in alignment once more with the port 6. Plural containers 7 may be obtained at any one time by the provision of plural through ports 5 in each tray 1 and the alignment of plural containers 7 above respective gas supply port 6, followed by the application of pressurised gas to all sets of through ports 5 in a single operation.

It will be appreciated that the system can be operated without support members 4 and with appropriate control of the supply of pressurised gas 6 to prevent a container falling downward through the aligned through ports 5 when it is in a position to be retrieved. Indeed, without the employment of such retaining members 4 and with appropriate control of the pressurised gas supply it is possible for containers to be dropped downward and retrieved from the base of the system. The gas supply can also be provided to control the raising and lowering rate of a particular container 7 to minimise any impact forces on the container 7.

The arrangement of the present invention enables a very simple handling mechanism to be provided yet does not compromise on the packing density provided by the system as a whole. Furthermore, it enables high speed retrieval of containers and therefore simple integration of the system as a whole as part of a larger automated process.

Claims

1. A storage and retrieval system comprising:
at least one storage tray comprising plural storage
5 holes; and
a gas supply manifold for supplying, in use,
pressurised gas to at least one gas supply port; wherein
the tray can be moved with respect to the manifold in
order to align a selected storage hole in the tray with the
10 port such that, in use, pressurised gas can be applied to
the selected hole via the port in order to allow controlled
movement of container stored in the selected hole to a
position in which it can be retrieved from the tray.
- 15 2. A system according to claim 1, wherein the pressurised
gas raises the container.
3. A system according to claim 1 or claim 2, wherein each
20 hole has a retaining member for retaining a container
therein.
4. A system according to any preceding claim, in which
there are provided plural trays, one arranged above
25 another.
5. A system according to claim 4, wherein each tray has
at least one through port therein in order to allow a
container to pass through the tray when the through port is
30 aligned with a manifold port.
6. A system according to any preceding claim, in which
the manifold has plural ports formed therein.
- 35 7. A system according to any preceding claim, in which
the trays are circular in shape.

8. A system according to any preceding claim, in which the trays are rotatable with respect to the manifold.

5 9. A system according to any preceding claim, further comprising means for controlling, in use, the pressure of gas supplied through the manifold in order to control the velocity or position of a selected container during retrieval and/or insertion.

1/3

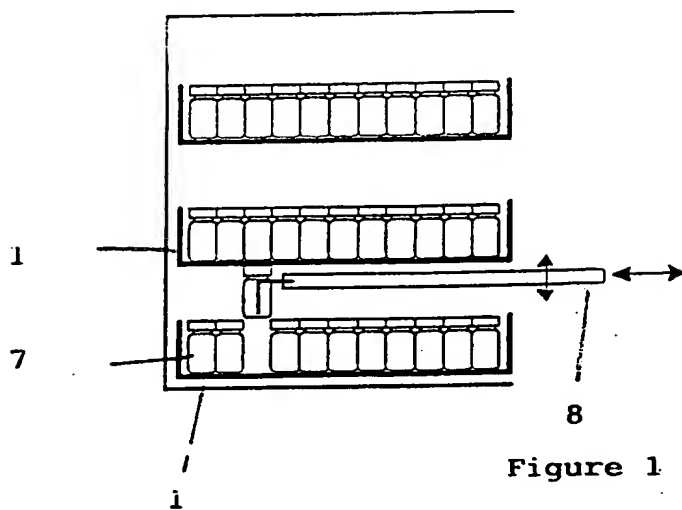


Figure 1

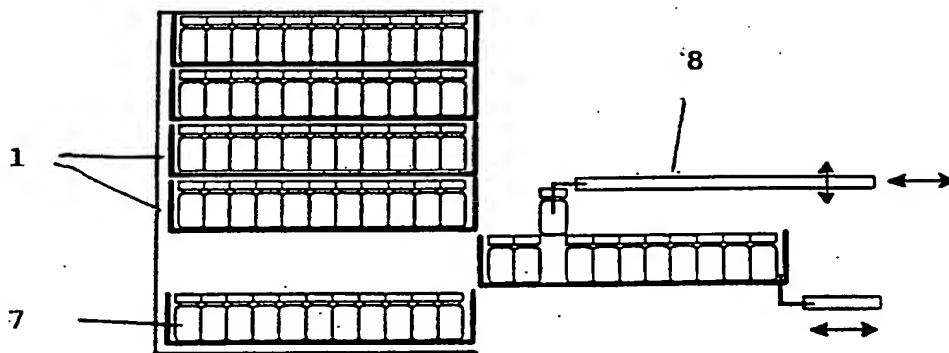


Figure 2

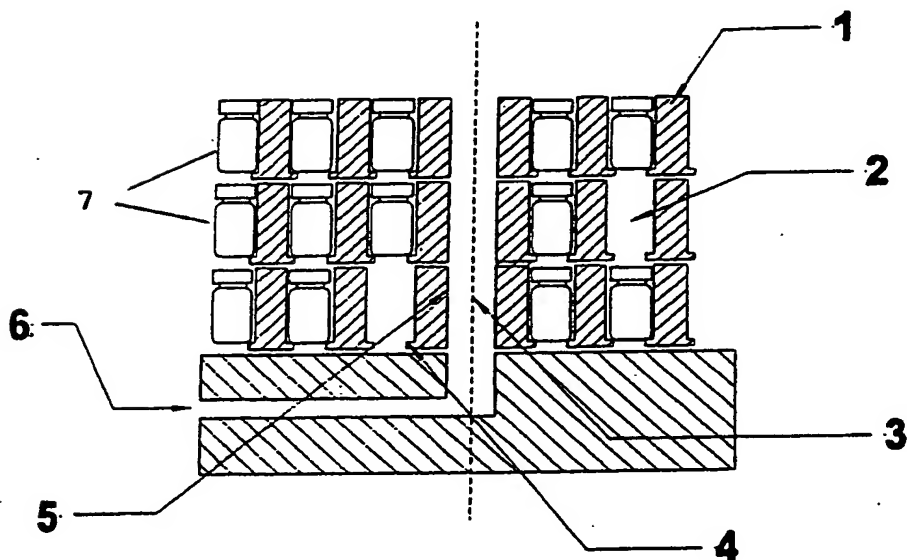


Figure 3

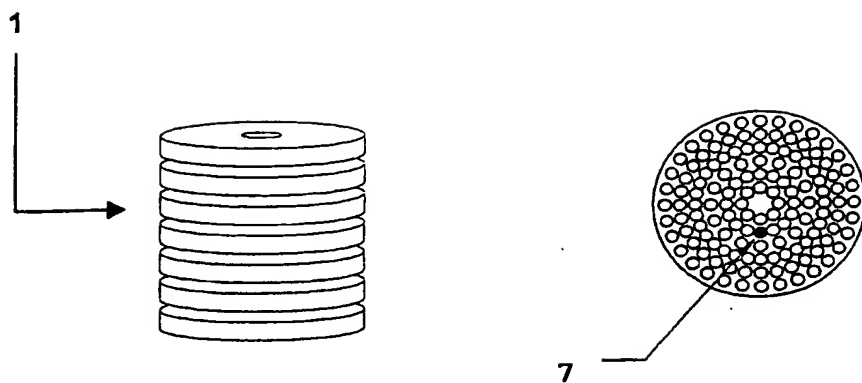


Figure 4

3/3

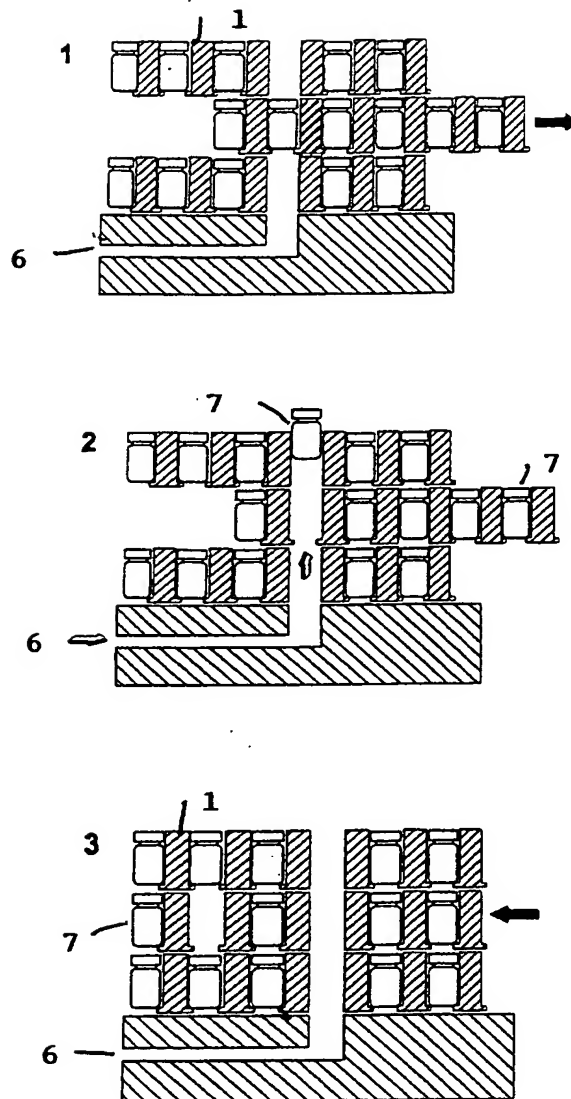


Figure 5

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference SAH01148W0	FOR FURTHER ACTION		see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/GB 00/ 02483	International filing date (day/month/year) 26/06/2000	(Earliest) Priority Date (day/month/year) 15/07/1999	
Applicant THE TECHNOLOGY PARTNERSHIP PLC et al.			

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 03 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of Invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1

☐ None of the figures.

CLAIMS

1. A storage and retrieval system comprising:
at least one storage tray comprising plural storage
5 holes;
at least one gas supply port ; and
a gas supply manifold for supplying, in use,
pressurised gas to the at least one gas supply port;
wherein
10 the tray is arranged such that it can be moved with
respect to the manifold in order to align a selected
storage hole in the tray with the port such that, in use,
pressurised gas can be applied to the selected hole via the
port in order to allow controlled movement of a container
15 stored in the selected hole to a position in which it can
be retrieved from the tray.
2. A system according to claim 1, wherein the gas supply
port is configured such that the pressurised gas raises
20 the container in use.
3. A system according to claim 1 or claim 2, wherein each
hole has retaining member for retaining a container
therein.
25
4. A system according to any preceding claim, in which
there are provided plural trays, one arranged above
another.
- 30 5. A system according to claim 4, wherein each tray has
at least one through port therein in order to allow a
container to pass through the tray when the through port is
aligned with a manifold port.
- 35 6. A system according to any preceding claim, in which
the manifold has plural ports formed therein.

AMENDED SHEET,

7. A system according to any preceding claim, in which the trays are circular in shape.
8. A system according to any preceding claim, in which the trays are rotatable with respect to the manifold.
9. A system according to any preceding claim, further comprising means for controlling, in use, the pressure of gas supplied through the manifold in order to control the velocity or position of a selected container during retrieval and/or insertion.

AMENDED SHEET

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/02483

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-4 as originally filed

Claims, No.:

1-9 as received on 06/04/2001 with letter of 05/04/2001

Drawings, sheets:

1/3-3/3 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/02483

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application.

☒ claims Nos. 2.

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 2 are so unclear that no meaningful opinion could be formed (*specify*):
see separate sheet

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos. .

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N) Yes: Claims 1, 3-9

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/02483

III.

Claim 2 does not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The claim attempts to define the subject-matter in terms of the result to be achieved which merely amounts to a statement of the underlying problem ("such that the pressurised gas raises the container in use").

V.

1. The most relevant prior art is regarded as being the one cited in the description part of the application.

The subject-matter of claim 1 is not disclosed by any prior art document taken alone or in any relevant combination with other prior art document and appears to meet the requirements of Article 33 (2) and (3) PCT.

In particular, document DE-A-41 01 257 (D1) discloses (cf. Fig. 2; col. 2, line 23 - col. 4, line 51; claim 1) a system comprising a tray with holes, a gas supply port and (implicitly) a supply manifold, but the system mentioned is a pneumatic post transporting system and not a storage and retrieval system. Lines 47-51 in col. 4 disclose that the pneumatic post station can also be used as an end station but without giving any indication on how this can be achieved and suggesting that the rotary body 12 can be formed as a storage tray.

The invention claimed in claims 1, 3-10 is industrially applicable in the sense of Article 33(4) PCT.

VII.

The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

The description is not in conformity with the claims as required by Rule 5.1(a)(iii) PCT.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/02483

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 4101257	A	09-01-1992	DE 9010080 U	06-09-1990
US 4793761	A	27-12-1988	NONE	
FR 2087081	A	31-12-1971	NONE	
JP 08081018	A	26-03-1996	JP 2985685 B	06-12-1999
EP 0786748	A	30-07-1997	ES 2113815 A	01-05-1998
			AU 699771 B	17-12-1998
			AU 1230797 A	31-07-1997

INTERNATIONAL SEARCH REPORT

Interr XXXXXXXXXX Application No
PCT/ XXXXXXXXXX 00/02483

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65G1/04 B65G51/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B65G B65B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 41 01 257 A (GRAU COMMUNICATIONS TECH GCT) 9 January 1992 (1992-01-09)	1,2,7,8
A	page 1, column 2, line 23 -page 2, column 4, line 51; figures ---	9
A	US 4 793 761 A (STERN HELMAN I) 27 December 1988 (1988-12-27) the whole document ---	1
A	FR 2 087 081 A (CIT ALCATEL) 31 December 1971 (1971-12-31) the whole document ---	1
	-/-	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

2 October 2000

Date of mailing of the international search report

09/10/2000

Name and mailing address of the ISA

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Authorized officer

Ostyn, T

INTERNATIONAL SEARCH REPORT

Interr Application No
PCT/JP 00/02483

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 07, 31 July 1996 (1996-07-31) & JP 08 081018 A (BROTHER IND LTD), 26 March 1996 (1996-03-26) abstract	1
A	EP 0 786 748 A (JOFEMAR I MAS D S L) 30 July 1997 (1997-07-30) page 4, column 6, line 10 -page 4, column 6, line 48; figures	4

PCT

REC'D 22 JUN 2001

WIPO

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

14

Applicant's or agent's file reference SAHO1148WO	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/GB00/02483	International filing date (day/month/year) 26/06/2000	Priority date (day/month/year) 15/07/1999
International Patent Classification (IPC) or national classification and IPC B65G1/04		
Applicant THE TECHNOLOGY PARTNERSHIP PLC et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 05/02/2001	Date of completion of this report 20.06.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Cazacu, C Telephone No. +49 89 2399 2645 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB00/02483

	No:	Claims	
Inventive step (IS)	Yes:	Claims	1, 3-9
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1, 3-9
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet